American Megatrends

SystemGuru™

HealthManager

For a well managed Windows NT server or workstation

MAN-SMS
3/25/97

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Revision History

3/25/97 Initial release.

Preface

The American Megatrends SystemGuru HealthManager provides local and remote server management features.

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Phone Numbers The BBS requires no parity, eight data bits, and one stop bit. The BBS phone numbers are:

Phone Number	Characteristics
770-246-8780	28,800 baud rate. Supports v.34.
770-246-8781	28,800 baud rate. Supports v.34.
770-246-8782	Supports HST and v.42.
770-246-8783	Supports HST and v.42.

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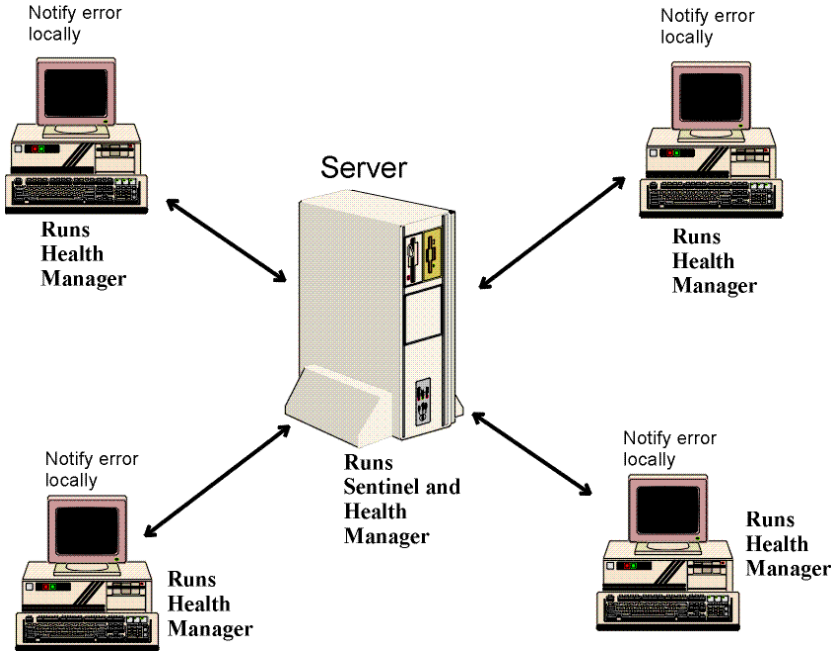
1 Overview

The American Megatrends SystemGuru utility is a comprehensive program that can report on and manage servers from a remote location. The currently available modules that are part of SystemGuru include:

Component	Description
Sentinel.	Runs only on the server. It monitors, reports, and logs operational data about key server operational parameters, such as CPU temperature.
HealthManager	Runs on both the server and all client computers. It displays the server parameters and DMI information for selected computers.

The following drawing shows how Sentinel and HealthManager work together:



Key Concepts

Hardware Health Functions Hardware Health Functions (HHF) are a collection of system performance parameters tailored for a specific system hardware architecture. A unique individual HHF is developed for each parameter. HealthManager constantly monitors the condition of the HHF and reports this condition to you.

DMI The Desktop Management Interface (DMI) is a new way to manage computers. DMI parallels the Plug and Play initiative. DMI specifies methods for making computer upgrades much easier.

DMI specifies a database of system information (the Management Information Format (MIF) database. Each computer can have a number of MIF files that contain information about the motherboard, adapter cards, and other computer components.

Using a utility program that can read MIF files, you can obtain a great deal of information about any DMI-aware computer. American Megatrends provides DMI Wizard 95, a DMI browser that displays this type of information.

DMI is a standard for organizing system configuration information. Using DMI, computer configuration can be made much simpler, quicker, and easier. Computer system configuration information can be read and modified from remote locations, permitting remote configuration and boot up.

Communication Protocols HealthManager and Sentinel use HTTP (Hypertext Transfer Protocol) to communicate over the Internet or an Intranet.

HealthManager

The American Megatrends SystemGuru HealthManager provides easy-to-use local and remote management of all servers in a system. HealthManager is a client browser that can run under Windows 95™ or Windows NT™ on the client system and under Windows NT on the server. Information is reported from Sentinel running on the server to the HealthManager running on both the server and the client computer. HealthManager can browse the server and the server BIOS DMI information locally or remotely. HealthManager is not a management applet. You can only browse information. HealthManager does not manage the server information.

SystemGuru HealthManager reports system data from sources on the motherboard. SystemGuru HealthManager gathers and processes system information. SystemGuru reports the system information in an easy-to use graphical format. SystemGuru works with components like the National Semiconductor LM78, LM75, LM79, and I^2C chips.

HealthManager monitors the server's critical system functions, such as CPU temperatures, voltages, fan status and other system level tests like memory errors. The monitored system health functions are hardware parameters that may vary, depending on the hardware platform system architecture.

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Client/Server Architecture The System HealthManager working areas are:

- the server site and
- the client site.

Server Functions From the server site, the system administrator can monitor the server parameters locally or can browse the server parameters through any other server as a remote connection.

Client Functions From the client site, you can only browse remote servers. The client site is a browser only application, it does not maintain the user-defined parameters globally. Instead, the client site saves these parameters locally in each client site.

For example: each client can set its own set of warning levels to monitor a server. If several users browse the same server, they may receive different error notification based on the warning level that has been set at this client site.

What Is Monitored The HealthManager monitors:

- different temperatures zones,
- different voltages,
- the CPU fan status,
- the chassis fan status, and
- the ECC memory status.

Sentinel

	Sentinel tracks and logs server health errors on the server.. Sentinel runs under Microsoft® Windows NT. Sentinel works with other SystemGuru modules such as HealthManager. Sentinel runs only as an independent process on the server or workstation. Sentinel runs online in real time. If you add an adapter card to the server, Sentinel reports the new system configuration information immediately via a network to the HealthManager running in the client computer.
Internet	Sentinel can work with Internet servers for remote server management. Sentinel posts the error log to the Internet server. When HealthManager generates a remote request, server management information is provided using the HTTP protocol.
Maximum Reported Devices	Sentinel can report on up to 256 devices in the server.

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User Interface The Sentinel user interface is simple. You can only set two parameters: Priority and Interval.

Parameter	Priority	Description
Priority	Sentinel is a multithreaded application. It uses the operating system's threading model for better system performance and responsiveness. Sentinel checks the machine periodically. You can set the interval and priority (see below). The lower the priority, the higher the system responsiveness and performance. If few tasks are being executed, the priority may not greatly determine performance.	
	Highest	Sentinel checks the machine at the user-defined interval. The operating system allocates time for Sentinel as a highest priority task.
	Above Normal	Sentinel checks the machine at the set interval if the operating system allocates time for Sentinel.
	Normal	Sentinel checks the machine at the set interval if the operating system allocates time for Sentinel.
	Below normal	Sentinel checks the machine at the interval if the operating system allocates time for it.
	Low	Operating system will allocate time for it as a low priority task. Sentinel checks the machine at the interval if operating system allocates time for it.
	Idle	This is the default priority. Sentinel acts as an idle task to the operating system. If the operating system does not have any task to perform, Sentinel is executed.
Interval		The interval is the frequency at which Sentinel checks the system health parameters. The interval can be 1 second to 3600 seconds. The server may not be checked at the specified interval, depending on the Sentinel priority level. If the system allocates time for Sentinel and if the time lapsed from the last checkup is greater than or equal to the interval, Sentinel checks the server.

Other Interfaces SystemGuru HealthManager will be able to interface with Intel® LANDesk®. This feature is not yet implemented.

2 Installation

The SystemGuru HealthManager is a client/server application. There are two parts:

- The Sentinel system monitor must be installed on server systems that are running Windows NT V4.0 or later.
- The HealthManager component can be installed on the server and on any number of client computers running Windows NT or Windows 95.

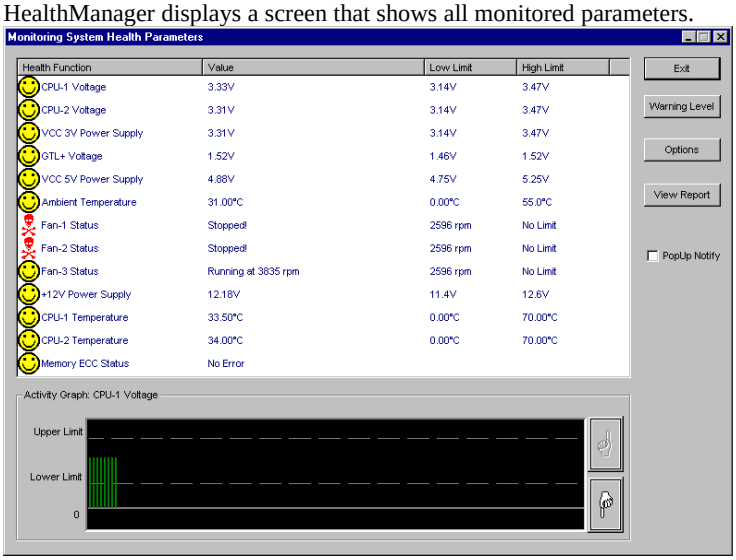
Installing the Server Component

The server component of the American Megatrends SystemGuru HealthManager is installed only on a server. This component reports information to the System Heath Monitor.

Server System Requirements The server must be running Microsoft Windows NT version 4.0 or later.

Installation Steps for Server

Step	Action
1	Install the Inetserver on the server. Change to the Inet directory on the Windows NT V4.0 CD. Run the Setup utility.
2	Make sure that you have loaded the TCP/IP protocol and that the server has a unique IP address or a unique machine name.
3	Insert the Server Site Disk 1 in floppy drive A:. Choose Run from File Manager. Type A:SETUP and click on the OK button.
4	Follow the instructions on the screen. All required files will be loaded. Make any necessary changes in the system configuration.
5	Reboot the computer after installation has completed.
6	Three program icons will be created in the SystemGuru program group on the Windows NT desktop: HealthManager, Sentinel, and Uninstall.
7	Double-click on the Sentinel icon. Click on the Start button to begin monitoring the server. ***You must run Sentinel first.*** ***Sentinel must be running in the server at all times.*** ***Never stop the Sentinel utility.***

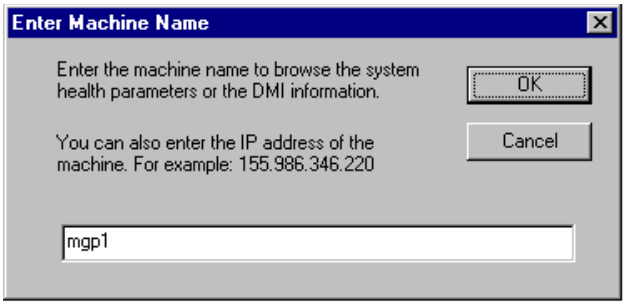
Step	Action
8	Double-click on the HealthManager icon. HealthManager is the browser. When you first start HealthManager, you can monitor the local computer or a remote computer. These options only appear when HealthManager is run on the server. Select Local Machine and click on the Monitor button. HealthManager displays a screen that shows all monitored parameters.  Double-click on the Uninstall utility only if you want to remove System HealthManager.

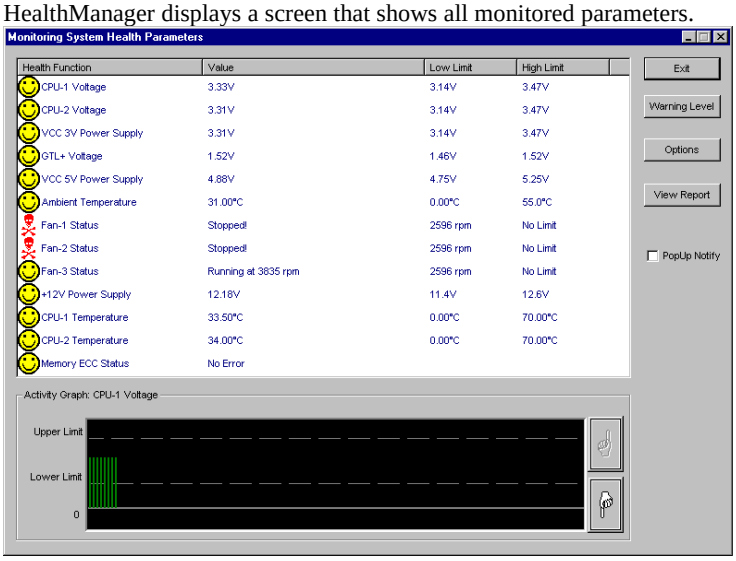
Installing the Client Component

The HealthManager component of the American Megatrends SystemGuru HealthManager is installed both on the server and all client systems.

Client System Requirements Computers running the client part of the SystemGuru HealthManager must be running under Windows NT Version 4.0 Server/Workstation or Windows 95.

Installation Steps for Client Computer

Step	Action
1	Make sure that you have installed Windows NT Version 4.0 Server/Workstation or Windows 95 on the client computer.
2	Make sure that you have loaded the TCP/IP protocol on the client computer.
3	Insert the Client Site Disk 1 in floppy drive A:. Choose Run from File Manager if running Windows NT or click on Start and choose Run if running Windows 95. Type A:SETUP and click on the OK button.
4	Follow the instructions on the screen. All required files will be loaded. Make any necessary changes in the system configuration.
5	Reboot the computer after installation has completed.
6	Two program icons will be created in the SystemGuru program group on the desktop: HealthManager and Uninstall.
7	Double-click on the HealthManager icon. HealthManager is the browser. Click on the Monitor button. HealthManager prompts for a machine name or IP address of the server to be browsed. Enter the server machine name or IP address. 

Step	Action
8	HealthManager displays a screen that shows all monitored parameters.  Double-click on the Uninstall utility only if you want to remove System HealthManager.

3 HealthManager Operation

The HealthManager, operating under Windows NT, polls the server hardware and software once a second and reports the results to the HealthManager client browser.

Data Reported HealthManager reports:

- the CPU operating temperature.
- the fan speed and status,
- the CPU voltage, and
- other system information.

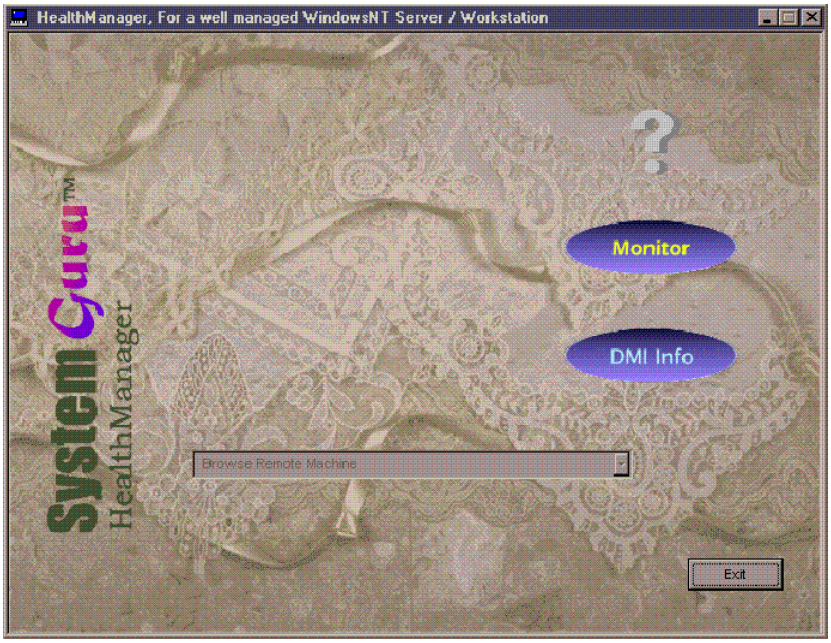
Features

HealthManager features include:

- remote access,
- can use the American Megatrends General Alert Module to report server data via email, broadcasting a failure alert message through a pager, executing a program on the client system, sounding an audible alarm on the client system, displaying a special icon on the client system screen, or by executing an SNMP trap *(the SNMP trap feature is under development),*
- allows the user to set the parameters for normal operating conditions, and
- reports ECC scrubbing.

Starting HealthManager

If running under Windows 95, click on the Start button then select HealthManager. If running under Windows NT, select HealthManager from the System Guru group. The following appears:



Running on the Server Site When HealthManager is executed at the server site, you can choose either Local Machine or Remote Server. Choose Local Machine to monitor the local server.

Running on the Client Site When HealthManager is executed at the client site, you can only browse A Remote Server.

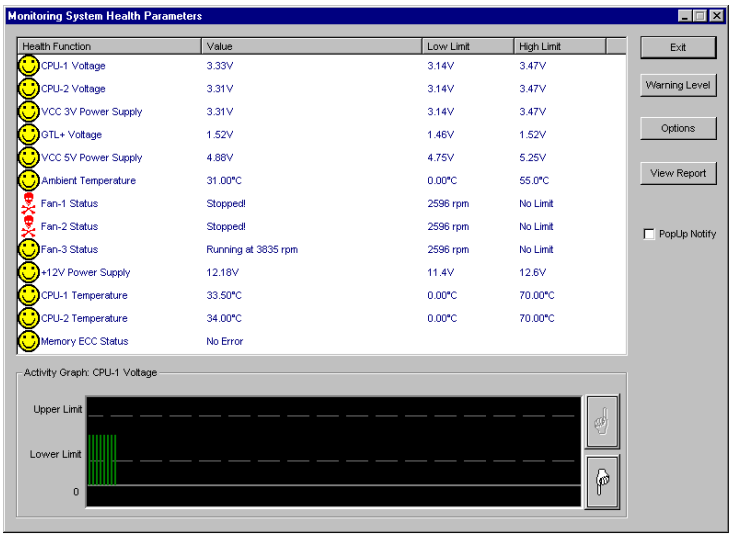
Options The options are Monitor and DMI Info.

Click on Monitor to display the HealthManager utility screen.

Click on DMI Info to display DMI information for the specified system. Turn to page 17 for additional information about displaying DMI information.

Display HealthManager

Monitor Click on Monitor to run the HealthManager utility, which display the real-time performance of the server system parameters. A screen like the following appears:



Monitor Icons The main monitor dialog displays the current HHF values for all parameters. The status report lists the current low and high limit for each HHF. If the HHF value is below the low limit or above the high limit, the warning icon is displayed. Each HHF parameter has an icon:

☺ indicates a normal safe operating condition.

☠ is a warning that the server parameter is out of range.

HealthManager Buttons The HealthManager screen buttons are described on the following page. These buttons are:

- Exit,
- Warning Level,
- Options,
- View Report, and
- Popup Notify.

HealthManager Parameters

Parameter	Column	
Health Function	First	The system parameter being monitored (CPU voltage, fan speed, etc).
Value	Second	The specified value for this parameter.
Low Limit	Third	The lowest acceptable value for this parameter. Any lower value triggers a warning message.
High Limit	Fourth	The highest acceptable value for this parameter. Any higher value triggers a warning message.

HealthManager Buttons

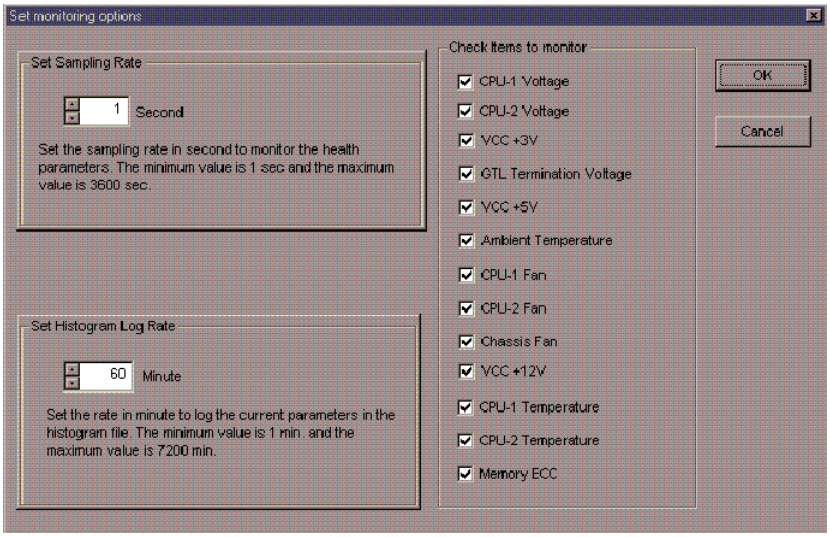
Warning Level Press this button to specify the upper and lower limits or any monitored HHF system parameters. Any HHF parameter value that falls below or above the warning levels generates an error condition. You must have System Administrator access to set this parameter for the server.

The system administrator can set individual warning level to generate alert for any HHF failure. Each warning level has a low limit and a high limit. A slider control is provided for each level. You can set a low limit and a high limit for each HHF, although limits for some HHFs cannot be set. If the current value of an HHF is lower than the low limit or higher than the high limit, an alert is generated internally. The alert is logged on the event log.

Local Limits You can set limits for the server on the client machine, but these limits are not active at the Server site. A global limit can be set by the system administrator only at the server site. But this feature is not implemented yet. It will be added soon. HealthManager is a browser and can monitor only. It is not yet a management applet. The limits set at the client site are local to each client. Each client can set individual limits and each client displays their own error notifications. The HHF parameters have slider controls to set low and high limits. For example: you can set low and high limits of 3.14 and 3.3V for the CPU voltage HHF parameter. You will receive an error notice if the CPU voltage falls outside these limits.

Cont'd

Options Press this button to set the sampling rate (how often the specified system parameters are queried) and the frequency of log entries in the system report. The following screen appears. You can change the Sampling Rate and Histogram Log Rate from this screen. Click on OK to return to the HealthManager screen..

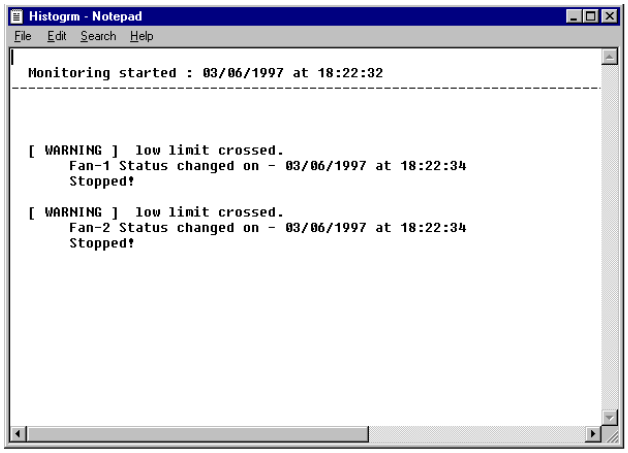


Choosing Items to Monitor Click on the checkbox beside any of the items listed on the right side of the window shown above to enable or disable monitoring of the selected item. For example, if you are monitoring a server that has only one CPU, you can turn off the HealthManager lines that display CPU-2 voltage or CPU-2 Fan.

Setting Options Set the sampling rate by clicking on Options. The first sampling rate button sets the monitor HHF status rate from one second to 3,600 seconds. The second button sets the log to history file rate from one minute to 7,200 minutes.

Cont'd

View Report Click on View Report to display the system event log. When an HHF changes state from safe level to alert or vice versa, an event is logged to a history file. This file can be viewed and saved as a user- defined file and can also be printed. The event log includes all changing states. If an HHF changes from normal to an error condition, the event is a “Warning” event. If an HHF changes from warning to normal, it is a “Safe” event. The event log includes the current value of the HHF and the current date and time.



Exit Clock on the Exit button to quit the HealthManager.

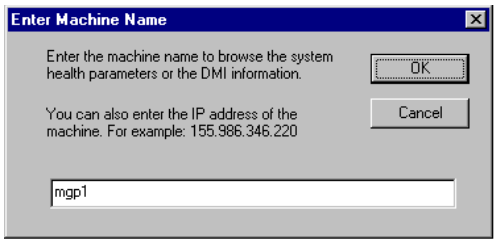
Popup Notify Error Click on this box to display an error message when an error occurs. The popup window is displayed after each monitoring interval until the problem is resolved. An message such as:

`Critical System Health Error!`

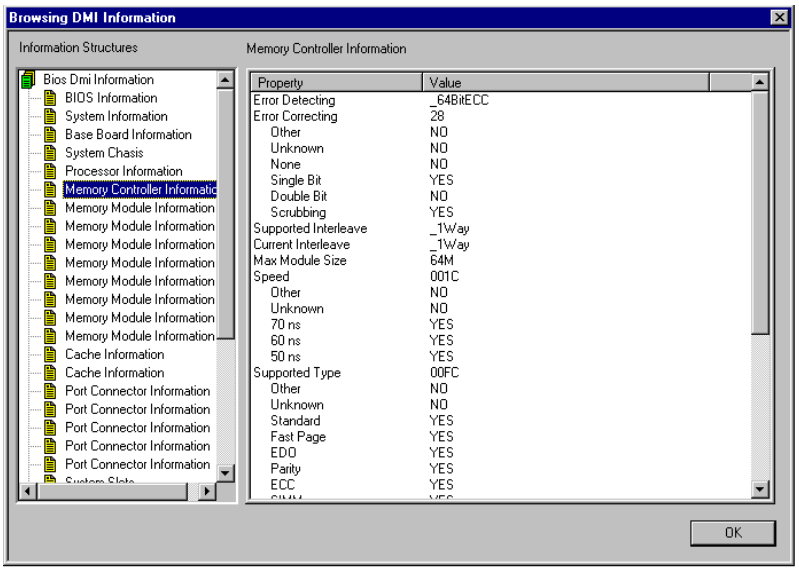
Use this option if the monitoring window is minimized or hidden.

DMI

Display DMI Information Click on DMI Info to display the information in the DMI MIF (Management Information Format) for the specified computer system. You can display the BIOS DMI information for any computer on a network if you know the DMI machine name. The following appears. Enter the DMI machine name and click on OK.



A screen such as the following appears. Click on any entry in the left side of the screen to display the associated system information.



DMI Browser

The DMI browser provides information about your computer. The information come from the system BIOS. This utility supports DMI version 2.0. The system BIOS provides services that allow the operating system to supply information about the system, such as the machine name, asset tag number, serial number, processor information, and memory information.

The DMI browser presents this information in a graphical interface. Currently, it does not generate a MIF file and does not work with the DMI Service Layer.

DMI Service Layer The DMI Service Layer is an operating system-dependent driver that acts as a common gateway to DMI PC management. The DMI Service Layer interfaces with all software and hardware components of the computer.

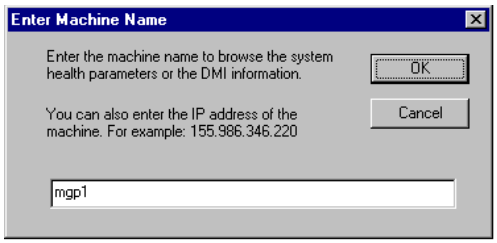
The DMI Service Layer stores this information about all hardware and software components in a MIF database that is not available to users and cannot be deleted. This database is a collection of MIF files. Each file has a ComponentID (a numeric handle by which the DMI Service Layer can access the information in the MIF file.

Remote Browsing

HealthManager can monitor health parameters from a remote machine, connected as a client. It uses HTTP protocol and works over Intranet or the Internet. For making this working server has to have the HTTP server loaded.

If you want to browse a remote machine, HealthManager asks for the machine name or the global IP address of the server. When using an Intranet, type the machine name within the network group. If using an Internet, type the IP address or the URL name of the machine to browse.

The following screen appears:



You can also use remote browsing to browse the DMI information in a different computer.

4 Desktop Management Interface (DMI)

The Desktop Management Interface (DMI) is a new way to manage computers. DMI parallels the Plug and Play initiative. DMI specifies methods for making computer upgrades much easier.

DMI specifies a database of system information (the Management Information Format (MIF) database. Each computer can have a number of MIF files that contain information about the motherboard, adapter cards, and other computer components.

Using a utility program that can read MIF files, you can obtain a great deal of information about any DMI-aware computer. DMI Wizard 95 displays this type of information.

DMI is a standard for organizing system configuration information. Using DMI, computer configuration can be made much simpler, quicker, and easier. Computer system configuration information can be read and modified from remote locations, permitting remote configuration and boot up.

DMI and PnP

DMI is a new way to manage computers. DMI parallels the Plug and Play initiative. It specifies methods for making computer upgrades much easier. The Desktop Management BIOS Specification follow the system device node model used in the Plug and Play BIOS specification.

DMI uses Plug and Play functions to access DMI information. Plug and Play functions INT 1Ah 50h through 57h are provided through the DMI BIOS interface.

MIF (Management Information Format)

DMI specifies a database of system information (the Management Information Format (MIF) database. Each computer can have a number of MIF files that contain information about the motherboard, adapter cards, and other computer components.

Using a utility program that can read MIF files, you can obtain a great deal of information about any DMI-aware computer.

DMI Basics

A basic grasp of the architecture of an AT computer can help you understand DMI. The main parts of every ISA computer are organized into separate DMI modules that contain system configuration information about the following computer parts:

- the BIOS,
- the system,
- the base board,
- the system chassis,
- the processor (CPU),
- the memory controller,
- the memory modules,
- cache,
- the port connectors,
- the system slots,
- onboard devices,
- OEM strings,
- system configuration,
- BIOS language, and
- group associations.

The American Megatrends DMI Wizard and DMI Wizard 95 utilities allow you to modify any of the above DMI structures.

DMI Data Structures

The DMI (Desktop Management Interface) specifies a number of data structures that are used when interfacing with the DMI-aware AMIBIOS system BIOS.

Every DMI structure has a formatted section and an optional unformatted section.

DMI Section Type	Description
Formatted	The formatted section begins with an optional four-byte header. The remaining data in the formatted section and the length of the section is determined by the structure type.
Unformatted	The unformatted section is used to pass variable data, such as text strings.

DMI Structured Header Every DMI BIOS structure begins with a four-byte header in the following format:

Offset	Name	Length	Description
00h	Type	Byte	This field specifies the structure. Types 0 - 127 are defined in the DMI specification. Types 128 - 256 are reserved for system- and OEM-specific information.
01h	Length	Byte	This field specifies the length of the formatted area of the structure. The length of the structure's stringset is not included. The structure begins with the *Type* field.
02h	Handle	Word	This field specifies the structure handle, a unique 16-bit number between zero and the total number of structures minus one. The handle is used with Function 51h Get DMI Structure to retrieve a specific structure.

Field	Description	Used in DMI function
NumStructures	Number of DMI structures	50h Get DMI Structure
dmiStrucBuffer	Text strings associated with a specified DMI structure	51h Get DMI Structure

DMI Text Strings Text strings associated with a specific DMI structure are returned in the buffer pointed to by the value in dmiStrucBuffer. Text strings are appended directly to the formatted part of the DMI structure. Each text string is terminated by a null byte (00h). Each set of text strings is terminated by an additional null byte (00h).

When the formatted part of the DMI structure references a text string, it specifies a non-zero string number that is part of the structure's string set.

Each text string is limited to 64 significant characters.

DMI BIOS Information

Offset	Name	Length	Value	Description
00h	Type	Byte	0	BIOS information indicator
01h	Length	Byte	13h	Length in bytes
02h	Handle	Word	Varies	
04h	Vendor	Byte	Varies	String number of the BIOS vendor name
05h	BIOS Version	Byte	Varies	String number of the BIOS version
06h	BIOS base address segment	Word	Varies	Segment location of the BIOS starting address. The size of the runtime BIOS image is computed by subtracting the starting address segment from FFFFh and multiplying the result by 16.
08h	BIOS release date	Byte	Varies	String number of the BIOS release date
09h	BIOS features	Qword	Bit field	**BIOS Functions:** Bits 63-48 System vendor Bits 47-31 BIOS vendor Bit 30 1 INT 10h CGA video Bit 29 1 INT 17h Parallel Port Bit 28 1 INT 14h Serial Port Bit 27 1 INT 09h Keyboard Service support Bit 26 1 INT 05h Print Screen Bit 25 1 INT 13h 3½" 2.88 MB floppy support Bit 24 1 INT 13h 3½" 720 KB floppy support Bit 23 1 INT 13h 5¼" 1.2 MB floppy support Bit 22 1 INT 13h 5¼" 360 KB floppy support Bit 21 1 INT 13h Toshiba 3½" 1.2 MB (1 KB /sector, 360 RPM) Bit 20 1 INT 13h NEC 9800 3½" 1.2 MB (1 KB /sector, 360 RPM) Bit 19 1 Support for EDD (Enhanced Disk Drive) Bit 18 1 Boot from PC Card Bit 17 1 Socketed BIOS ROM Bit 16 1 Selectable boot Bit 15 1 Boot from CD-ROM Bit 14 1 ESCD support. Bit 13 1 VESA™ VL-Bus™ Bit 12 1 BIOS shadowing. Bit 11 1 BIOS on flash ROM. Bit 10 1 APM support. Bit 9 1 Plug and Play. Bit 8 1 PCMCIA support Bit 7 1 PCI support. Bit 6 1 EISA support. Bit 5 1 MCA support. Bit 4 1 ISA support.
11h	ROM size	Word	Varies	The size is 16 KB times (n+1)

DMI System Information (Type 1)

The information in this structure defines the system attributes. This table is associated with the Component ID group of the MIF in the computer.

Offset	Name	Length	Value	Description
00h	Type	Byte	01h	Component ID information indicator
01h	Length	Byte	08h	Length in bytes
02h	Handle	Word	Varies	
04h	Manufacturer	Byte	Varies	Number of null-terminated string
05h	Product name	Byte	Varies	Number of null-terminated string
06h	Version	Byte	Varies	Number of null-terminated string
07h	Serial number	Byte	Varies	Number of null-terminated string

DMI Motherboard Information (Type 2)

The information in this structure defines the motherboard attributes.

Offset	Name	Length	Value	Description
00h	Type	Byte	02h	Motherboard information indicator
01h	Length	Byte	09h	
02h	Handle	Word	Varies	
04h	Manufacturer	Byte	Varies	Number of null-terminated string
05h	Product name	Byte	Varies	Number of null-terminated string
06h	Version	Byte	Varies	Number of null-terminated string
07h	Serial number	Byte	Varies	Number of null-terminated string
08h	POST error status	Word	Bit field	Specifies the POST errors that occurred: Bits 15-9 Reserved. Must be zero. Bit 8 1 RAM test failed. Bit 7 1 Keyboard test failed. Bit 6 1 Power management initialization failed. Bit 5 1 Video BIOS failed. Bit 4 1 CMOS checksum failed. Bit 3 1 BIOS ROM checksum failed. Bit 2 1 Error reporting not supported. Bit 1 Unknown Bit 0 Other

DMI Chassis Information (Type 3)

The information in this DMI structure defines the computer's mechanical enclosure. If a computer has a separate enclosure for peripheral devices, two Type 3 DMI structures are returned: one for the main computer and one for the peripheral enclosure.

Offset	Name	Length	Value	Description
00h	Type	Byte	03h	System enclosure indicator
01h	Length	Byte	09h	
02h	Handle	Word	Varies	
04h	Manufacturer	Byte	Varies	Number of null-terminated string
05h	Type	Byte	Varies	Bit 7 Chassis lock present if set. Bits 6-0 Chassis type 01h Other 02h Unknown 03h Desktop 04h Low profile desktop 05h Pizza box 06h Minitower 07h Tower 08h Portable 09h Laptop 0Ah Notebook 0Bh Handheld 0Ch Docking station 0Dh All-in-one 0Eh Subnotebook 0Fh Space-saving 10h Lunchbox 11h Main server chassis 12h Expansion chassis 13h Subchassis 14h Bus expansion chassis 15h Peripheral chassis 16h RAID chassis 17h Rack-mount chassis
06h	Version	Byte	Varies	Number of null-terminated string
07h	Serial number	Byte	Varies	Number of null-terminated string
08h	Asset tag number	Byte	Varies	Number of null-terminated string

DMI Processor Information (Type 4)

The information in this structure defines the attributes of a single processor. If this structure is for a multiprocessor computer, a separate DMI structure is provided for each processor in the computer. A second DMI structure is provided for any coprocessor (such as a 487SX math coprocessor).

Offset	Name	Length	Value	Description
00h	Type	Byte	04h	Processor information indicator
01h	Length	Byte	1Ah	
02h	Handle	Word	Varies	
04h	Socket Designation	Byte	Varies	String number for reference designation
05h	Processor Type	Byte	ENUM	01h Other 02h Unknown 03h Central processor 04h Math coprocessor 05h DSP processor 06h Video processor
06h	Processor family	Byte	ENUM	01h Other 02h Unknown 03h Intel 8086 04h Intel 80286 05h Intel 80386 06h Intel 80486 07h Intel 8087 08h Intel 80287 09h Intel 80387 0Ah 80487 0Bh Intel Pentium family 0Ch Intel Pentium Pro family 0Dh Intel OverDrive family (New CPU core technologies adapted to existing sockets). 20h PowerPC family
07h	Processor manufacturer	Byte	Varies	String number of processor manufacturer
08h	Processor ID	Qword	Varies	Raw processor identification data. For the Intel x86 CPUs, the format of this field depends on the processor support for the CPUID instruction. If CPUID is support, this field contains two doubleword-formatted values The first value (offset 08h-0Bh) is the EAX value returned by a CPUID instruction with EAX set to 1. The second value (offset 0Ch - 0Fh) is the EDX value returned by CPUID.
10h	Processor version	Byte	Varies	String number that describes the processor
11h	Voltage	Byte	Varies	Bits 7-4 Reserved. Must be zero. Bit 3 Reserved. Must be zero. Bit 2 2.9V CPU if set. Bit 1 3.3V CPU if set. Bit 0 5V CPU if set. The CPU socket voltage is configurable if more than one of the bits from 2-0 are set.
12h	External clock	Word	Varies	The external clock frequency. This field is zero if the value is unknown.

Offset	Name	Length	Value	Description
14h	Maximum speed	Word	Varies	99d for a 99 MHz processor. This field is zero if the value is unknown.
16h	Current speed	Word	Varies	99d for a 99 MHz processor. This field is zero if the value is unknown.
18h	Status	Byte	Varies	Bit 7 Reserved. Must be zero. Bit 6 CPU socket 0 CPU socket populated. 1 CPU socket not populated. Bits 5-3 Reserved. Must be zero. Bits 2-0 CPU status 000 Unknown 001 CPU enabled 10 CPU disabled by user through BIOS Setup 011 CPU disabled by system BIOS because of POST error. 100 CPU is idle. CPU waiting to be enabled. 111 Other
19h	Processor upgrade	Byte	ENUM	01h Other 02h Unknown 03h Daughterboard 04h ZIF socket 05h Replaceable piggyback 06h None

DMI Memory Controller Information (Type 5)

The information in this DMI structure defines the memory controller and memory module attributes. Memory modules not controlled by the memory controller are not included.

Offset	Name	Length	Value	Description
00h	Type	Byte	05h	Memory controller indicator
01h	Length	Byte	Varies	14 + (2 times the number of associated memory slot), offset 0Dh.
02h	Handle	Word	Varies	
04h	Error detecting method	Byte	ENUM	01h Other 02h Unknown 03h None 04h 8-bit parity 05h 32-bit ECC 06h 64-bit ECC 07h 128-bit ECC
05h	Error correcting capability	Byte	Bit field	Bit 5 Error scrubbing if set. Bit 4 Double bit error correcting if set. Bit 3 Single bit error correcting if set. Bit 2 None if set. Bit 1 Unknown if set. Bit 0 Other if set.
06h	Support interleave	Byte	ENUM	01h Other 02h Unknown 03h One way interleave 04h Two way interleave 05h Four way interleave 06h Eight way interleave 07h Sixteen way interleave
07h	Current Interleave	Byte	ENUM	01h Other 02h Unknown 03h One way interleave 04h Two way interleave 05h Four way interleave 06h Eight way interleave 07h Sixteen way interleave
08h	maximum memory module size	Byte	Varies (n)	The size of the largest memory module support (per slot). Specifies as n, where 2**n is the maximum size in MB. The maximum amount of memory support by this controller is 2**n times the number of slots, as specified in 0Dh Number of associated memory slots.
09h	Support speeds	Byte	Bit field	Bits 7-5 Reserved. Must be zero. Bit 4 50 ns Bit 3 60 ns Bit 2 70 ns Bit 1 Unknown Bit 0 Other

Offset	Name	Length	Value	Description
0Ah	Support memory types	Word	Bit field	Bits 15-9 Reserved. Must be 0. Bit 8 DIMM Bit 7 SIMM Bit 6 ECC Bit 5 Parity Bit 4 EDO Bit 3 Fast page mode Bit 2 Standard Bit 1 Unknown Bit 0 Other
0Ch	Memory module voltage	Byte	Varies	This field specifies the required voltages for each memory socket controlled by this controller Bits 7-3 Reserved. Must be 0. Bit 2 2.9V if set Bit 1 3.3V if set Bit 0 5V if set The voltages for each socket are configurable if more than one bit of bits 2-0 are set.
0Dh	Number of associated memory slots	Byte	Varies	This field defines the number of memory module information blocks controlled by this memory controller.
0Eh	Memory module configuration handle	Word	Varies	This is a memory information structure index controlled by this controller. The value in *offset 0Dh Number of associated memory slots* defines the count.

DMI Memory Module Information (Type 6)

The information in this DMI structure defines memory module attributes. One of these DMI structures is included for each memory module socket in the computer. This structure describes the speed, type, size, and error status of each system memory module. The support attributes of each module are described in the DMI memory controller information structure that owns this module.

Offset	Name	Length	Value	Description
00h	Type	Byte	06h	Memory module configuration indicator
01h	Length	Byte	0Dh	
02h	Handle	Word	Varies	
05h	Socket designation	Byte	Varies	Bits 7-4 specify a memory bank (RAS#) connection. Bits 3-0 specify a different memory bank (RAS#) connection. 0Fh specifies that there is no memory bank connection. For example: if memory banks 1 and 3 (RAS#1 and RAS#3) were connected to SIMM sockets, the value in this field would be 13h. If only bank2 (RAS#2) is connected, this field would contain 2Fh.
06h	Current speed	Byte	Bit field	Bits 7-5 Reserved. Must be zero. Bit 4 50 ns Bit 3 60 ns Bit 2 70 ns Bit 1 Unknown Bit 0 Other
07h	Upgrade speed	Byte	Bit field	Bits 7-5 Reserved. Must be zero. Bit 4 50 ns Bit 3 60 ns Bit 2 70 ns Bit 1 Unknown Bit 0 Other
08h	Current Memory Type	Word	Bit field	Bits 15-9 Reserved. Must be zero. Bit 8 DIMM Bit 7 SIMM Bit 6 ECC Bit 5 Parity Bit 4 EDO Bit 3 Fast page mode Bit 2 Standard Bit 1 Unknown Bit 0 Other
0Ah	Installed size	Byte	Varies (n)	The size of the memory module installed in the memory socket. If the computer cannot detect memory, this field is set to 7Dh. Bit 7 Type of connector 0 Single bank 1 Double bank Bits 6-0 Size(n), where 2**n is the size in MB. There are three special cases: 7Dh Memory cannot be determined. 7Eh Memory module installed, but not enabled. 7Fh Not installed.

Offset	Name	Length	Value	Description
0Bh	Enabled Size	Byte	Varies	The amount of memory currently enabled. If a memory module has been installed in the socket but all memory in the module has been disabled, this field is set to 7Eh. Bit 7 Type of connector 0 Single bank 1 Double bank Bits 6-0 Size(n), where 2**n is the size in MB. There are two special cases: 7Eh Memory module installed, but not enabled. 7Fh Not installed.
0Ch	Error status	Byte	Varies	Bits 7-2 Reserved. Must be set to 0. Bit 1 Correctable errors received for the module if set. Bit 0 Uncorrectable errors received for the module. All or part of the module has been disabled.

DMI Cache Information Structure (Type 7)

The information in this structure defines the cache memory attributes. One of these DMI structures is specified for each cache memory device in the computer, no matter if the cache memory is internal or external to the CPU module. Cache modules can be associated with a processor structure.

Offset	Name	Length	Value	Description
00h	Type	Byte	07h	Cache memory information indicator
01h	Length	Byte	0Fh	
02h	Handle	Word	Varies	
04h	Socket designation	Byte	Varies	This field contains a string number for reference designation.
05h	Cache configuration	Word	Varies	Bits 15-10 Reserved. Must be zero. Bits 9-8 Operational mode 00 Write-through 01 Write-back 10 Varies with memory address 11 Unknown Bit 7 Status at boot time 0 Disabled 1 Enabled Bits 6-5 Location relative to CPU module 00 Internal 01 External 10 Reserved 11 Unknown Bit 4 Reserved. Must be zero. Bit 3 Cache socketed 0 Not socketed 1 Socketed Bits 2-0 Cache Level 000 Level 1 001 Level 2 010 Level 3 011 Level 4 100 Level 5 101 Level 6 110 Level 7 111 Level 8
07h	Maximum cache size	Word	Varies	This field contains the maximum cache memory that can be installed. Bit 15 Granularity 0 1 KB 1 64 KB Bits 14-0 Maximum size in units equal to the cache memory granularity.
09h	Installed size	Word	Varies	This field contains the installed cache memory size. Bit 15 Granularity 0 1 KB 1 64 KB Bits 14-0 Maximum size in units equal to the cache memory granularity.

Offset	Name	Length	Value	Description
0Bh	Support SRAM type	Word	Bit field	Bits 15-7 Reserved. Must be zero. Bit 6 Asynchronous Bit 5 Synchronous Bit 4 Pipeline burst Bit 3 Burst Bit 2 Non-burst Bit 1 Unknown Bit 0 Other
0Dh	Current SRAM type	Word	Bit field	Bits 15-7 Reserved. Must be zero. Bit 6 Asynchronous Bit 5 Synchronous Bit 4 Pipeline burst Bit 3 Burst Bit 2 Non-burst Bit 1 Unknown Bit 0 Other

DMI Port Connector Information (Type 8)

The information in this structure defines the attributes of a serial, parallel, mouse, or keyboard port connector. One of these DMI structures is present for each port in the computer. For example: if there are three serial ports, there will be three separate DMI structures, one for each serial port.

Offset	Name	Length	Value	Description
00h	Type	Byte	08h	Connector information indicator
01h	Length	Byte	07h	
02h	Handle	Word	Varies	
04h	Reference Designator	Byte	Varies	This field contains a string number for reference designation, for example: SERIAL1.
05h	Connector type	Byte	ENUM	Connector type 01h Centronics 02h MiniCentronics 03h Proprietary 04h Male DB25 05h Female DB25 06h Male DB15 07h Female DB15 08h Male DB9 09h Female DB9 0Ah RJ11 0Bh RJ45 0Ch 50-pin miniSCSI 0Dh MiniDIN 0Eh MicroDIN 0Fh PS/2 10h Infrared 11h HP-HIL 12h Access bus 13h SSA SCSI 14h Male circular 8-pin DIN 15h Female circular 8-pin DIN

Offset	Name	Length	Value	Description
06h	Port type	Byte	ENUM	Port type 00h None 01h XT/AT-compatible parallel port 02h PS/2 Parallel Port 03h ECP parallel port 04h EPP parallel port 05h ECP/EPP parallel port 06h XT/AT-compatible serial port 07h 16450-compatible serial port 08h 16550-compatible serial port 09h 16550A-compatible serial port 0Ah SCSI port 0Bh MIDI port 0Ch Joystick port 0Dh Keyboard port 0Eh Mouse port 0Fh SSA SCSI 10h USB 11h Firewire (IEEE P1394) 12h PCMCIA Type I PC Card 13h PCMCIA Type II PC Card 14h PCMCIA Type III PC Card 15h CardBus 16h Access bus port

DMI System Slots (Type 9)

The information in this structure defines the computer expansion slot attributes. One DMI structure is provided for each expansion slot in the computer.

Offset	Name	Length	Value	Description
00h	Type	Byte	09h	Expansion slot structure indicator
01h	Length	Byte	09h	
02h	Handle	Word	Varies	
04h	Slot Designation	Byte	Varies	This field contains a string number for reference designation, for example: PCI-1.
05h	Slot type	Byte	ENUM	**Slot type** 01h Other 02h Unknown 03h ISA 04h MCA 05h EISA 06h PCI 07h PCMCIA 08h VESA VL-Bus 09h Proprietary 0Ah Processor card slot 0Bh Proprietary memory card slot 0Ch I/O riser card slot 0Dh NuBus
06h	Slot data bus width	Byte	ENUM	**Slot data bus width** 01h Other 02h Unknown 03h 8-bit 04h 16-bit 05h 32-bit 06h 64-bit 07h 128-bit
07h	Current usage	Byte	Byte	**Expansion slot current usage** 01h Other 02h Unknown 03h Available 04h In use
08h	Slot length	Byte	ENUM	**Expansion slot length** 01h Other 02h Unknown 03h Half-length 04h Full-length

DMI Onboard Device Information (Type 10)

The information in this structure defines the onboard device attributes. Many devices (such as video, SCSI, IDE, network) are mounted on the motherboard and thus are onboard devices.

Offset	Name	Length	Value	Description
00h	Type	Byte	10h	Onboard device information indicator
01h	Length	Byte	Varies	4 + (number of devices times 2).
02h	Handle	Word	Varies	
04h	Device 1 type	Byte	Varies	Bit 7 Device 1 status 0 Device disabled 1 Device enabled Bits 6-0 Device Type 01h Other 02h Unknown 03h Video 04h SCSI 05h Ethernet 06h Token ring 07h Sound
05h	Description string	Byte	Varies	This field contains the number of string that describes Device 1.
06h	Device 2 type	Byte	ENUM	Bit 7 Device 2 status 0 Device disabled 1 Device enabled Bits 6-0 Device Type 01h Other 02h Unknown 03h Video 04h SCSI 05h Ethernet 06h Token ring 07h Sound
07h	Description string	Byte	Varies	This field contains the number of string that describes Device 2.

DMI OEM Strings (Type 11)

Offset	Name	Length	Value	Description
00h	Type	Byte	11h	OEM string information indicator.
01h	Length	Byte	05h	
02h	Handle	Word	Varies	
04h	Count	Byte	Varies	Number of strings

DMI System Configuration Options (Type 12)

Offset	Name	Length	Value	Description
00h	Type	Byte	12h	Configuration information indicator
01h	Length	Byte	05h	
02h	Handle	Word	Varies	
04h	Count	Byte	Varies	Number of strings

DMI BIOS Language Information (Type 13)

Offset	Name	Length	Value	Description
00h	Type	Byte	12h	Language information indicator
01h	Length	Byte	06h	
02h	Handle	Word	Varies	
04h	Installable language	Byte	Varies	This field contains the number of languages available. Each available language has a description string. This field contains the number of strings that follow.
05h	Current language	Byte	Varies	This field contains a string number of the currently installed language.

DMI Group Associations (Type 14)

Offset	Name	Length	Value	Description
00h	Type	Byte	14h	Group association indicator
01h	Length	Byte	Varies	5 + (Three bytes for each item in the group).
02h	Handle	Word	Varies	
04h	Group name	Byte	Varies	This field contains the string number of the text string that describes the group.
05h	Item type	Byte	Varies	This field contains the item (structure type) of this member.
06h	Item handle	Word	Varies	This field contains the handle that corresponds to the structure.

DMI System Event Log (Type 15)

If a DMI System Event Log is included in the DMI data, the computer supports an event log. An event log is a fixed-length area in NVRAM. The event log begins with a vendor-specific fixed-length header record, followed by one or more variable-length log records.

Offset	Name	Length	Value	Description
00h	Type	Byte	15h	Event log type indicator
01h	Length	Byte	14h	This field contains the length of this structure, including the Type and Length fields.
02h	Handle	Word	Varies	This field contains the handle (instance number) associated with the record.
04h	Log area length	Word	Varies	This field contains the length (in bytes) of the total event log area, from the first byte of the header through the last byte of data.
06h	Log header start offset	Word	Varies	This field specifies the starting offset (or index) of the event log header in NVRAM. The Access Method Address field at offset 0Ah in this DMI structure defines the method used to access the event log area. The most significant byte of the start offset is set to 00h for single-byte indexed I/O accesses. This field is set to 00h if the event log area has no header.
08h	Log data start offset	Word	Varies	This field specifies the starting offset (or index) of the first data byte in the event log in NVRAM. The Access Method Address field at offset 0Ah in this DMI structure defines the method used to access the event log area. The most significant byte of the start offset is set to 00h for single-byte indexed I/O accesses. The data directly follows the header information. The header length is determined by subtracting the Log Header Start Offset value (in offset 06h) from the Log Data Start Offset value (at offset 08h) in this DMI structure.
0Ah	Access Method	Byte	Varies	This field specifies the method used to access the event log area: 00h Indexed I/O using a one-byte index and a one-byte data field. The Access Method Address field at offset 10h contains the one-byte index I/O address followed by the one-byte data I/O address. 01h Indexed I/O using a two-byte index and a one-byte data field. The Access Method Address field at offset 10h contains the two-byte index I/O address (in Intel Word format) followed by the one byte data I/O address. 02h Memory-mapped physical 32-bit address. The Access Method address field at offset 10h contains the four-byte index I/O address (in Intel Dword format) starting physical address. 03h Available via Function 55hGet General Purpose NVRAM Information. 04h-FFh Reserved for future use.
0Bh	Log Status	Byte	Varies	The bit field specifies the current status of the system event log. Bits 7-2 Reserved. Must be zero. Bit 1 Log area full if set. Bit 0 Log area valid if set.

Offset	Name	Length	Value	Description
0Ch		Qword	Zeros	Reserved for future use.
10h	Access Method Address	Dword	Varies	This field specifies the address associated with the access method. The data present depends on the value in the Access Method field at offset 0Ah in this DMI structure. The format of the area is described by the following packed C union: union { struct { char Index; char Data; } IOSingleByte; struct { int Index; char Data; } IODoubleByte; long PhysicalAddr32; } AccessMethodAddress;

DMI Event Log Organization The event log includes an optional implementation-specific fixed-length header and one or more variable-length event records, as shown below. The format of the event log header and the size of the total event log area can change. All event log area fields are consistent across all applications on all computers. The event log area operates as a write-once clear-all log.

Optional Log Header (eight bytes)								
Type	**Length**	**Year**	**Month**	**Day**	**Hour**	**Min**	**Sec**	**Log Variable Data**

All fields are required except the Log Variable Data field.

Cont'd

Event Log Record Header Each event log record includes a required fixed-length header followed by optional data defines by the event type. The fixed-length log record header occupies the first eight bytes of every log record. The log header includes:

Offset	Field Name	Format	Description
00h	Event type	Byte	This field specifies the type of event noted in the event log entry. The event log types are: 00h Reserved 01h Single-bit ECC memory error 02h Multi-bit ECC memory error 03h Parity memory error 04h Bus timed out 05h I/O channel check 06h Software NMI 07h POST memory resize 08h POST error 09h PCI parity error 0Ah PCI system error 0Bh CPU failure 0Ch Fail-Safe timer timed out 0Dh Correctable memory log disabled 0Eh Error logging disabled 0Fh Reserved 10h System limit exceeded 11h Asynchronous system reset 12h System configuration information 13h Hard disk information 14h System reconfigured 15h Uncorrectable CPU complex error 16h Log area reset and cleared 17h System boot 18-7Fh Reserved for future use. 80-FFh Available for system- and OEM-specific assignments.
01h	Length	Byte	This field specifies the byte length of the event record, including the record type and length fields. If the most significant bit of the field is 0, the record has been read. If it is 1, the record has not been read. If the field has been read, it likely y has been processed by a higher-level layer of software.
02h-07h	Date and time fields	Byte	This field contains the BCD representation of the date and time of the most recent occurrence of the logged event as read from NVRAM. The format of this field is: year, month, day, hour, minute, and second.
08h Plus	Log variable data	Varies	This field contains optional event-specific additional status information.